



Making a Hard-Shell Mold

Written By: Adam Savage



TOOLS:

- [Clay-sculpting tools \(1\)](#)
wire loop, carver, etc.
- [Hot glue gun \(1\)](#)
- [Marker \(1\)](#)
- [Paintbrush \(a few\)](#)
- [Pencil \(1\)](#)
- [Putty knife \(a few\)](#)
or screwdrivers
- [Rags \(1\)](#)
- [Rolling pin \(1\)](#)
- [Squirt bottle \(1\)](#)
- [X-Acto knife \(1\)](#)



PARTS:

- [Model piece \(1\)](#)
the original that you want to cast
- [Aluminized tape \(1\)](#)
- [Silicone rubber \(1\)](#)
for moldmaking
- [Silicone rubber thickener \(1\)](#)
optional
- [Silicone rubber accelerator \(1\)](#)
optional
- [Silicone sealant \(1\)](#)
- [Spun hemp \(1\)](#)
- [Stone plaster \(1\)](#)
- [Casting resin \(1\)](#)
- [Water-based pottery clay \(1\)](#)
- [Foam core \(1\)](#)
- [Plastic hemispheres \(1\)](#)
available at any plastics supply store
- [Vaseline \(1\)](#)
or mold release

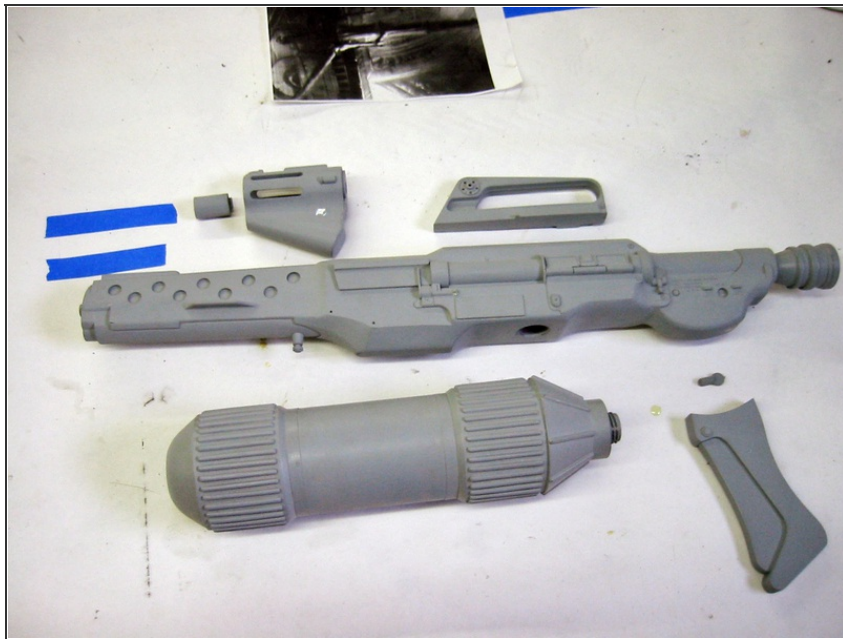
SUMMARY

Silicone block molds are fine for making casts of small objects. But for larger items, like this 3' prop gun, you'd need hundreds of dollars' worth of silicone to make a block mold.

An excellent and inexpensive solution is to use a thin layer (or "blanket") of silicone, that's keyed to a hard-shell or "mother" mold. It's a multi-step process, but it yields great results for the cost-conscious mold maker. It also makes much lighter molds, which are easier to move around.

With this type of mold making, you're basically sculpting the 2 sides of your mold, taking into account the forces involved in the pouring and casting of the part. It takes a while, but if you get good at hard-shell mold making, you can cast just about anything, no matter how big.


Step 1 — Getting started.



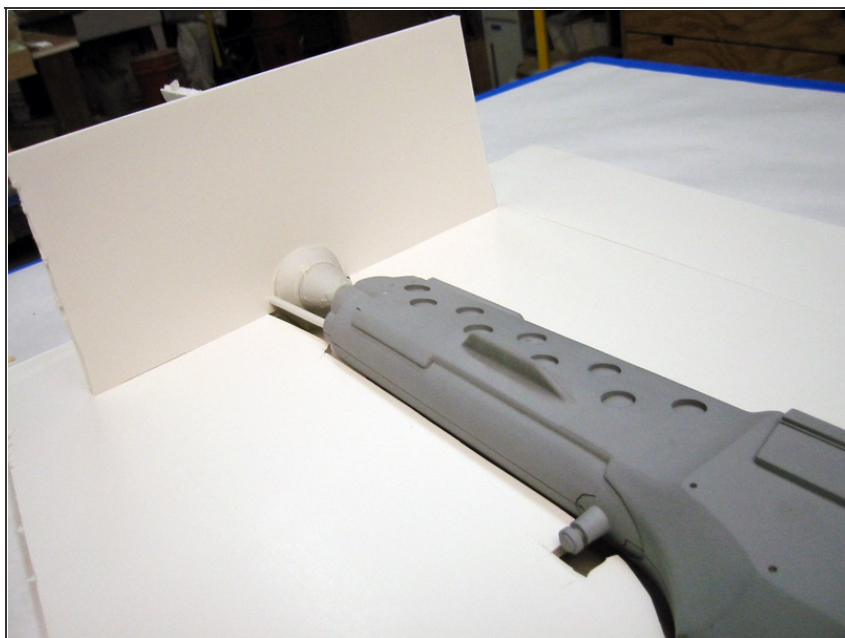
- The silicone is poured into 2 halves, and each half registers into its respective mother mold. Before doing anything else, take a permanent marker and draw a parting line down the exact middle of the original part, marking 2 symmetrical halves. This is the line you'll sculpt everything to — even with simple objects like this, every mold maker I know does it, and you should too.

Step 2 — Pre-fill any voids.



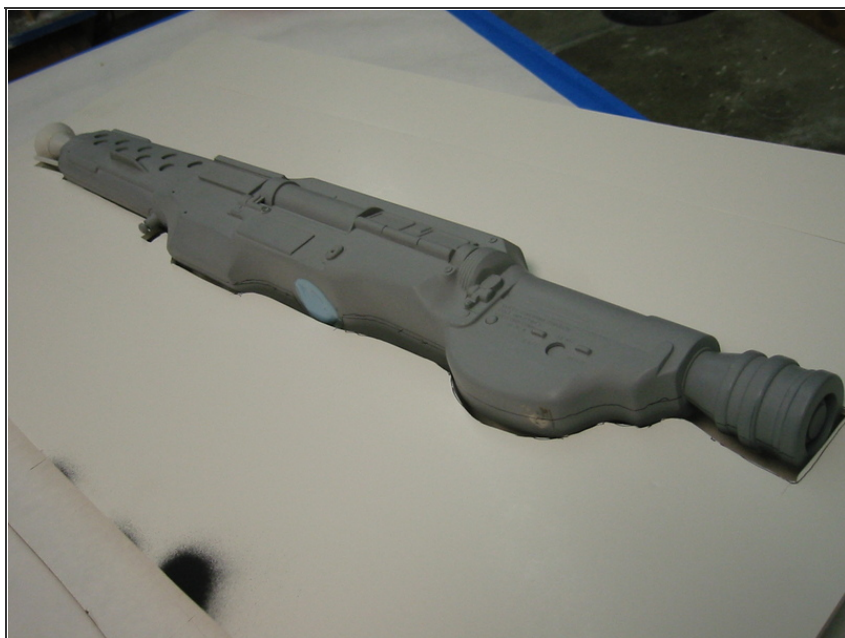
- Before we make the mold itself, we need to make your original model mold-worthy. To prep it, you'll need to pre-fill up any small or difficult-to-access voids in the model, such as the hole in the bottom of our prop gun body, which you can see in this image (circled). This is a void on the model that has threads to join to another part of the model.
- I knew that if I poured that void in 2 parts and from the side, I'd end up with air bubbles galore. So I pre-filled it with a plug made of blue silicone. The plug should stick to the blanket of silicone that I pour later, and become a nice part of the mold.
- Prior to pouring the silicone, you'll need to clean the  plugs thoroughly with mineral spirits to make sure they'll stick.

Step 3 — Make a foam-core “table.”



- Next, we'll make a table out of foam-core on which to sculpt the first half of the mold. Use a piece of foam-core that's large enough to extend at least 8"–10" beyond the borders of the part. (A common mistake people make with these molds is not giving themselves enough surface area to work on.)
- Place the model on its side with the parting line parallel with the foam-core and trace around it with a pencil, as close to the model as possible.
- Cut the model shape out of the foam-core and discard.
- Secure the model on a sturdy work table (oil-based clay is great for this step), making sure the parting line is as level as possible.
- Now, we need to position the foam-core so that it sits about 1/4" below the centerline of the model. We'll be creating a clay dam to use as a reservoir for the silicone, and that 1/4" allows for the thickness of the clay to come right to the middle parting line.

Step 4



- Measure from the parting line to the table. Let's say it's 2".
- Subtract $\frac{1}{4}$ " for your clay dam, which gives us $1\frac{3}{4}$ ".
- Subtract the thickness of the foam-core ($\frac{3}{16}$ "), which takes us to $1-\frac{9}{16}$ ".
- Cut a few dozen little strips of foam-core 3"—4" long to this exact height, in our case $1-\frac{9}{16}$ ".
- Place the model on the table, and spread the upright strips around it evenly, covering an area the size of the cut-out foam-core piece.
- Use hot glue to adhere the upright chunks to the table and to the large foam-core piece, which should be placed on top of them to create a nice solid foam-core surface.



Step 5 — Make a funnel for pouring the casting resin.



- Now you need to decide where the top of your mold will be, into which you'll pour the casting resin. It should be located at the perimeter of the model where it comes to a steep point, so bubbles will surface and pop in a small area.
- Because you'll be pouring into this part, it's a good idea to add a piece to your foam-core table that gives you a nice clean surface for pouring the resin into the mold. And you'll need a vent nearby to give the air you're displacing with the casting resin somewhere to go (other than back through the hole you're pouring from). This helps eliminate bubbles, and makes pouring the mold a cleaner, less splash-prone process.
- In this image, you can see the funnel-shaped pouring gate and next to it a smaller vent.


Step 6 — Make the clay dam.



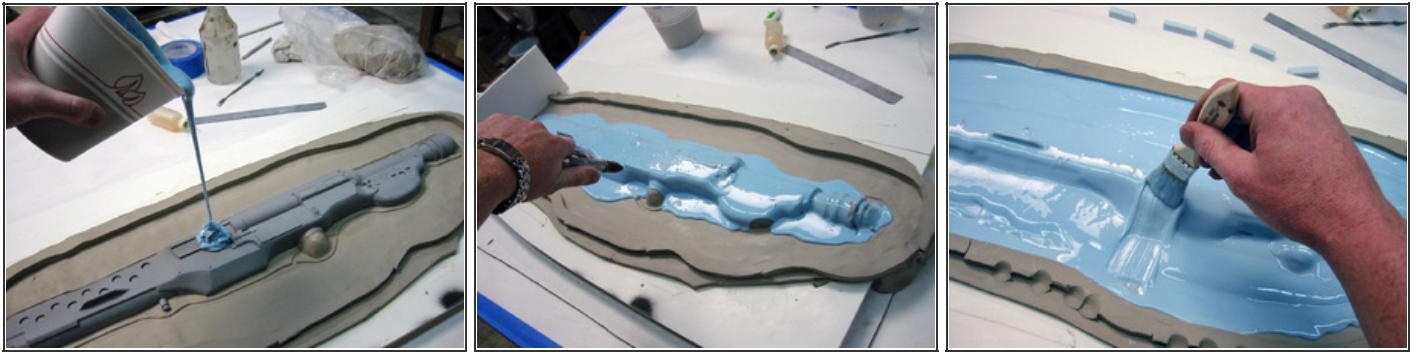
- Since you want the clay to be a uniform thickness, a rolling pin is ideal for the job. I use water-based clay, the kind used for pottery, because oil-based clay and silicone don't always get along. 
- Flatten the clay with your hands, and when it's a little more than 1/4" thick, place the clay pieces between 2 rails (wood will do) that are exactly 1/4" high, positioned perpendicular to the rolling pin and close enough together that they're underneath its rolling surface.
- Roll the clay to a 1/4" thickness — use a squirt bottle of water to keep it from getting sticky.
- The first image shows the clay dam, mostly laid out onto the foam board. It goes on in pieces, which you can join together with your fingers.
- Use a clay tool to bring the clay dam right up to the model.
- The line where the clay meets the model should be very smooth, perpendicular, and have no gaps. The cleaner this area is, the easier it will be to get good castings. 
- After finessing the clay dam, clean all clay residue off the model with a damp brush (otherwise it will be cast in when you pour your silicone!).



Step 7 — Make the barrier key and border.



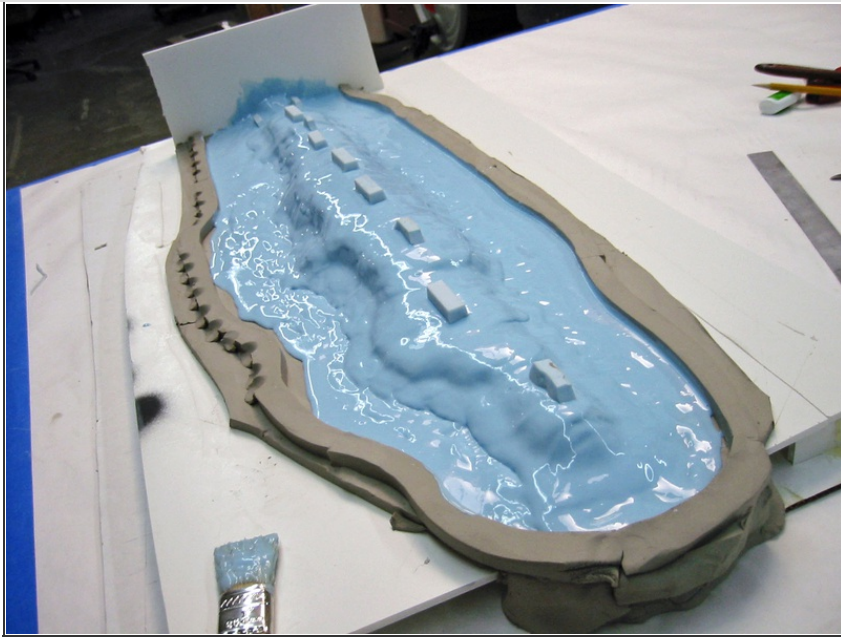
- Use a wire-loop clay tool to make the first of the “barrier keys” (or more accurately, registration topography) that will hold the 2 halves of this mold perfectly aligned.
- Keys for molds come in many shapes and sizes, but for large molds, a key that runs all the way around the part helps prevent the resin from leaking out. I usually go a bit deeper than a half-circle’s depth, then clean the edges with a wet soft paintbrush. 
- This image shows the completed barrier key around the part, and a raised clay border (made using the rolling pin method described in the previous step) built up all the way around the part, with spacing of about 3".


Step 8 — Pour the first blanket.



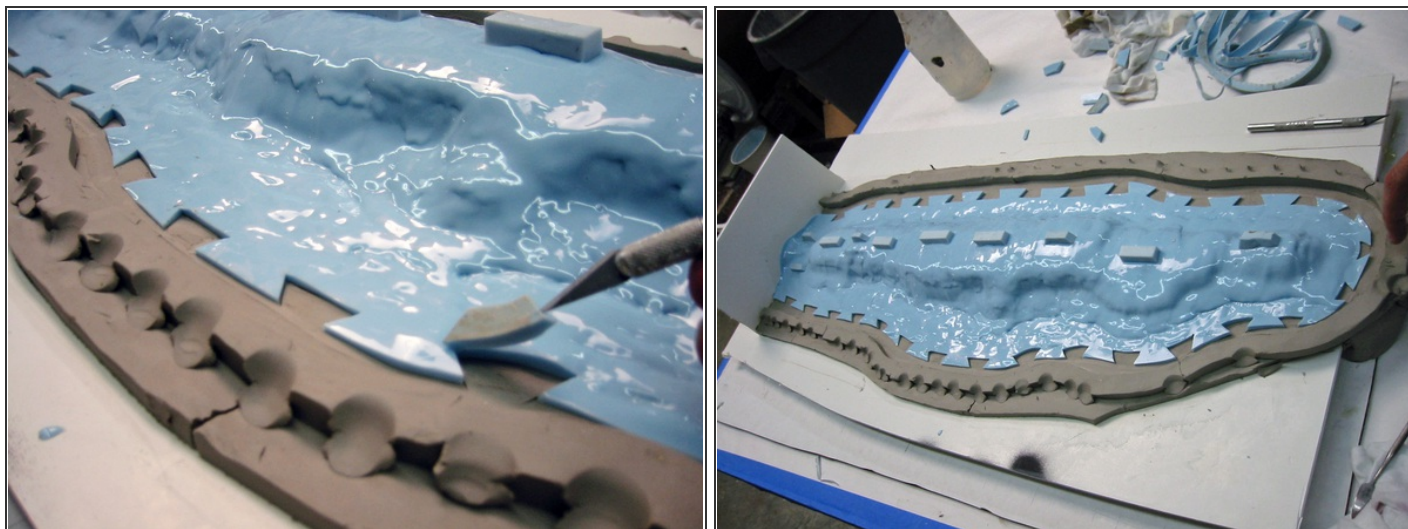
- The first layer of silicone is the most important one, because it's what grabs all the detail from your model. To avoid bubbles, pour slowly from one location and from high up, letting the silicone drift slowly into the detail on the model.
- You can use accelerator in the silicone (or use more kicker) to make it kick faster, but that will make for a weaker mold. If you need only 1 or 2 castings, it's OK to use an accelerator (they can speed up the setting time from 10 hours to 3), but if you want to make dozens of castings, be patient. 
- With the first thin layer covering the model, blow compressed air over the part (don't get too close) to eliminate any bubbles.
- When the first layer is just past the tacky stage, brush on another layer of silicone, making sure it's of uniform thickness all over the model.
- For this application, you can add thixotropic agents to increase the silicone's viscosity (but not on the first layer, as these agents make it difficult to get the silicone into all the nooks and crannies for high detail). 



Step 9 — Apply silicone keys.



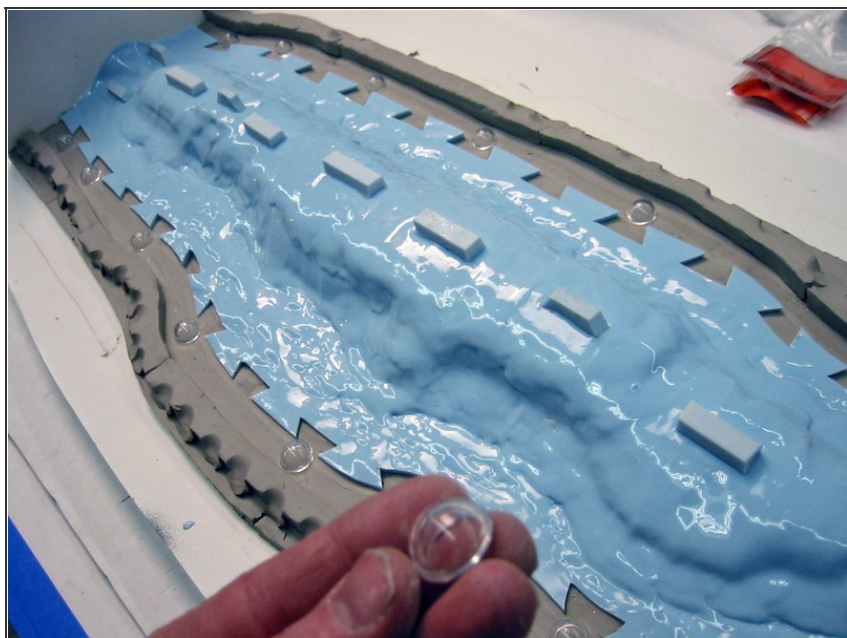
- Once the second layer is applied for the first blanket of silicone, and while that layer is still wet and tacky, start applying the silicone keys. These will help the silicone stay adhered to the inside of the hard plaster mold. While the advantage of this method is that it uses less silicone, the disadvantage is that the thin silicone layer lacks structure and must be married to the plaster mold so it doesn't collapse.
- I made these keys from an old silicone mold by cutting small wedges about 1½" long by about a pinky width (make sure that the silicone for the keys and the mold are the same brand; it helps them stick better). For this mold, I set keys in the wet silicone about every 3".
- As every mold is different, you have to imagine your mold upright and think through the weak spots, where it will buckle, and place the keys accordingly. 
- This image shows the mold with the keys in place all the silicone is poured (for the first half), and it's setting up nicely. The silicone doesn't go all the way to the border on the left, but that's OK.
- Next we'll be cutting dovetail keys around the perimeter.

Step 10 — Cut the dovetail keys.



- After the silicone has cured, trim the edge of the blanket to get a smooth line, and discard the trimmed pieces. Use a sharp X-Acto knife to cut dovetail-shaped keys around the perimeter, gingerly lifting up the edge of the blanket and slicing upward so you don't cut into the clay below.
- This serrated edge will help the silicone blanket register to the mother mold. My blanket here is a wee bit thin at the outer edge. I could probably have trimmed it closer, like about an inch away from the model. 
- The second image here shows the finished blanket. I've probably used the minimum number of dovetail keys necessary to keep the blanket stable in the mother mold, but you should err on the side of caution and add more than you think the mold might need.
- Too many keys just makes the mold more stable, but too few and you've wasted a lot of work. 

Step 11 — Add hemispherical keys.



- I've left space around the edges of the silicone so I can place hemispherical keys (pictured here). These will register the 2 halves of the mother mold together. I'm using injection-molded $\frac{3}{4}$ " plastic hemispheres, available at any plastics supply store, placed lightly on the clay every 5" or so, just inside the border.
- Brush a small amount of Vaseline or other mold release onto them to help remove them from the first half of the plaster mother mold.

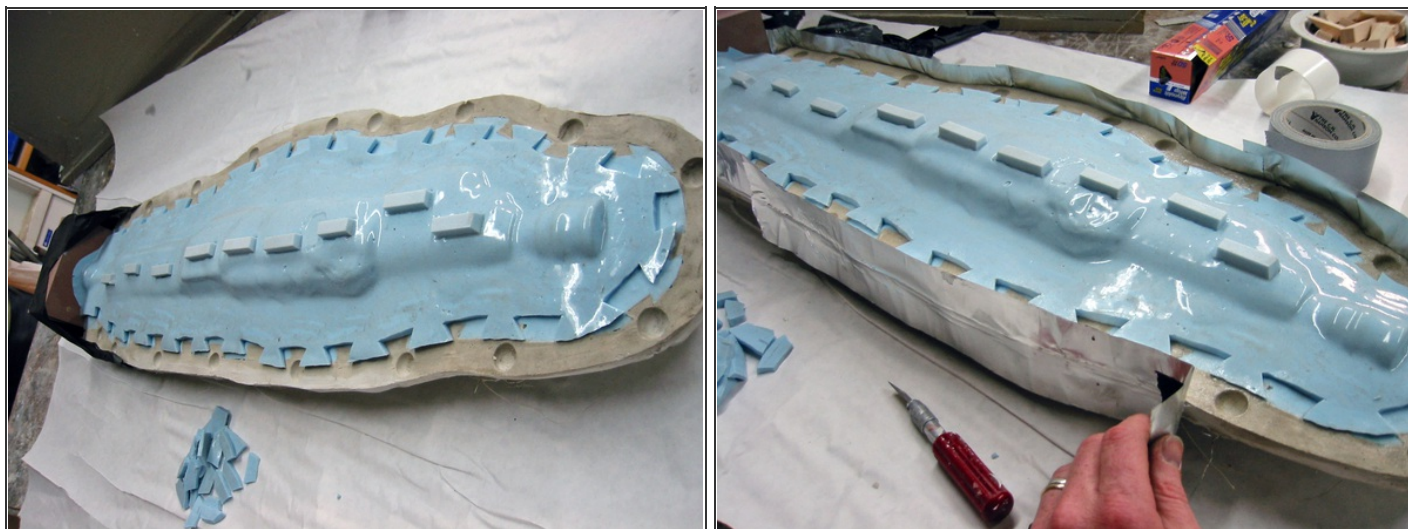
Step 12 — Plaster over the silicone.



- After the first blanket of silicone comes the stone-plaster mother mold. The plaster will go on in a couple of layers. The first layer is a thin coat for detail — apply it slowly to avoid creating bubbles. The second is supported by a hemp strengthener.
- The first image shows the first layer of plaster applied over the blanket, the clay, and the keys. It's fairly thick and will take somewhere around an hour to set. Stone plaster is much stronger than regular plaster. You can get away with using less, which keeps your mold lightweight, but it's still brittle like regular plaster.
- So the next step is to reinforce it with some spun hemp, available from mold-making supply stores. The hemp works much like fiberglass, supplying a matrix that increases the plaster's flexibility and makes it shatter-resistant. Add a layer of hemp, then apply the second and final layer of plaster.
- Don't wait more than a day between plaster coats, or else the second layer might not stick well to the first. Also note that the first layer of set-up plaster will suck water from the new layer, making it set faster than the first.
- Once the second layer's set, turn the whole thing over and gently pull off the clay dam, keeping the model inside the mold. Take a moment to study what you've done. Isn't it pretty? The various mold keys are all visible now: the hemispherical keys in the outer ring of plaster, the dovetail keys where the silicone meets the plaster, and the barrier key around the model itself.



Step 13 — Make the second silicone blanket.



- Before applying a layer of silicone to the other side of the model, you'll have to clean it and prepare it well — but be careful not to mess with it too much, as you want as tight a registration as possible. Use a brush and soft damp cloth to remove any clay residue.
- Apply mold release (or a thin layer of Vaseline) to the silicone so that the next layer won't stick to it. Make sure you cover it all, or else you'll ruin your mold. Silicone loves to stick to itself. Apply 2 layers of silicone exactly as you did in Step 6. As before, use very little accelerator in the first layer, but you can use more, or a higher mix of the kicker, in the second. Remember: the goal is to get a ¼" blanket all around the part.
- As with the first blanket, place the silicone key wedges along the center of the model before the second layer of silicone hardens. Cut the dovetail keys from the second layer, gingerly lifting up the edge to avoid cutting into the layer below.
- The second image shows the mold with the second silicone blanket done and cut. Now it's time to lay on the plaster for the other half of the mother mold. You're almost there!

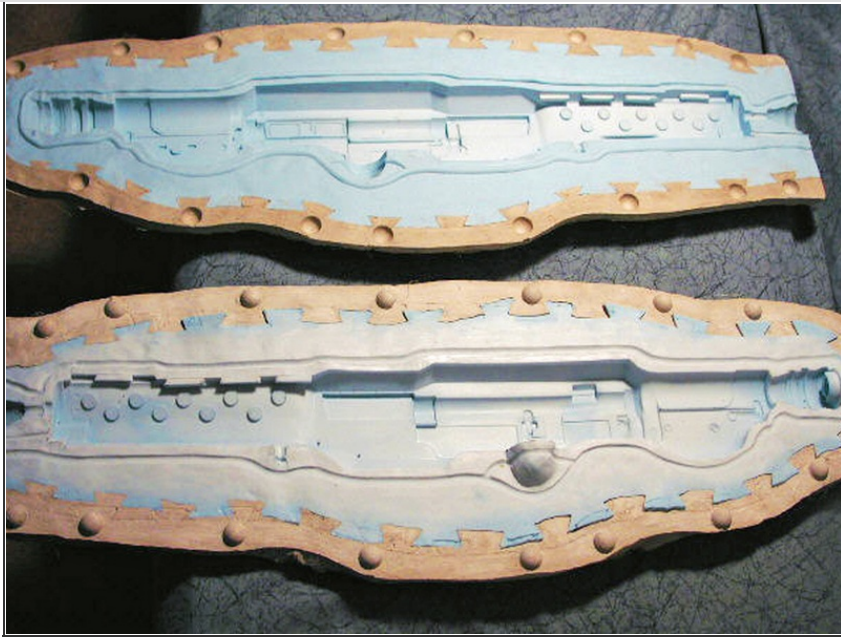
Step 14 — Make the second half of the hard-shell mold.



- To prep for the second plaster, apply mold release to the first plaster half. Again, a thin layer of petroleum jelly works great. Cover the inside of all the hemispherical key indentations because, again, if they don't release, all your work is down the toilet.
- Using aluminized tape, available in the plumbing or heating section of any hardware store, build a simple mold dam to contain the wet plaster and give it a nice crisp edge that matches the clay dam from the first blanket.
- Slowly drip the plaster onto the second blanket of silicone. Again, this first layer is for detail, and the fewer bubbles it has, the better it will hold.
- Use your hand to spread the plaster over the blanket, making sure it covers everything, especially the silicone wedge keys along the center.
- Be careful around the edge of the blanket, where the dovetail keys are! This edge may want to lift up, and you don't want to get any plaster under it between the 2 layers of silicone. Better to drip the plaster gingerly around the edge. This is an important point to remember, and the more familiar you are with this whole process, the less likely you are to forget a key step and end up wasting your hard-earned time.
- The third image shows the first layer of plaster. Note how well the aluminized tape dam holds it in. Also note how clean the workspace around the mold is. This type of moldmaking is very detail-intensive, and attention to cleanliness during the molding process will quite simply yield a better product.



Step 15



- Allow the second layer of stone plaster (with hemp below it) to dry in all its glory. Once it's dry, all you have to do is pull off the tape and gently pry the halves apart. Since plaster is brittle, care must be taken not to over-torque the mold, lest it crack.
- Use 2 screwdrivers or sturdy putty knives, one leapfrogged in front of the other, to proceed down the seam. As you go, listen for the telltale sound of the halves letting go of each other. Go slowly! You don't want a cracked mother mold before you've even started casting.
- Making your way down a full side of the mold halves should be sufficient for a proper separation. After a time, you'll hear a sucking sound and see that the 2 halves have popped apart. The 2 silicone blankets should be somewhat stuck together now, but simply grabbing one of them and pulling it off the other should do the trick (if you've properly applied the mold release.) Then pull out the model to reveal your finished mold.
- This image shows our completed mold. Everything worked perfectly. Note the lack of air bubbles in the positive hemispherical keys on the bottom half. These should register the 2 halves of the mother mold beautifully. And they did.

Step 16 — Use your mold.



- This image shows a completed assembly of a resin casting from this mold. To reduce air bubbles on a large part like this, you can first pour some resin in each half and let it cure, then assemble the 2 halves and pour a final resin middle to get the completed casting.
- With proper cycling (letting the silicone cool down between castings — heat kills molds), this mold should easily yield 20 or more castings before deteriorating. Because the blanket is thin and the plaster sucks heat out during the resin's curing process, it could even yield 50 castings.

This project first appeared in [MAKE Volume 24](#), page 109.

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